

## CURRICULUM VITAE

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### CURTIS M. OLDENBURG

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### EDUCATION

1979-1983 University of California, Berkeley. A.B. in geology, Dec. 1983.

1984-1985 Princeton University, Ph.D. program in geology.  
Transferred with advisor to U.C. Santa Barbara, fall 1985.

1985-1989 University of California, Santa Barbara. Ph.D. in geology, Sep. 1989.

### PH.D. DISSERTATION

Numerical experiments of double-diffusive convection in magma bodies

### RESEARCH INTERESTS

- Geologic Carbon Sequestration
  - Injection of CO<sub>2</sub> for carbon sequestration and enhanced gas recovery (CSEGR)
  - Near-surface leakage and seepage of CO<sub>2</sub>
  - Risk assessment of geologic carbon sequestration sites
- Porous media compressed air energy storage (PM-CAES)
- Heat and mass transfer in geologic systems
- Dynamic behavior of subsurface systems where convection or gravity-driven flow processes occur (e.g., geothermal systems, gas reservoirs, magmatic systems, saturated and vadose zone hydrology, ferrofluid flow)

- Code development and applications

<http://esd.lbl.gov/TOUGH2>

[http://esd.lbl.gov/FILES/research/projects/tough/licensing/TOUGH\\_EOS7C\\_flyer.pdf](http://esd.lbl.gov/FILES/research/projects/tough/licensing/TOUGH_EOS7C_flyer.pdf)

<http://lnx.lbl.gov/GasEOS>

## PROFESSIONAL EXPERIENCE

Geological Senior Scientist, LBNL, September 2013–present.  
Geologic Carbon Sequestration Program Lead, June 2008–present.  
Staff Geological Scientist, LBNL, October 1994–August 2013.  
Geologic Carbon Sequestration Program Deputy Lead, April 2007–May 2008.  
Hydrogeology Department Head, LBNL, May 2002–January 2006.  
Geological Scientist, LBNL, July 1992–September 1994.  
Post-doctoral Fellow, LBNL, October 1990–June 1992.  
Post-doctoral researcher, UC Santa Barbara, October 1989– September 1990.  
Research Assistant, U.C. Santa Barbara, July 1986–September 1989.  
Teaching Assistant, U.C. Santa Barbara, October 1985–June 1986.  
Assistant in Instruction, Princeton University, January–May 1985.  
Assistant in Research, Princeton University, September–December 1984.  
Assistant Field Geologist, Chevron Resources, March–August 1984.

## PROFESSIONAL ACTIVITIES

Editor in Chief, *Greenhouse Gases: Science and Technology*, Wiley, January 2010 to present.  
Guest Editor of Special Issue on Geologic Carbon Sequestration, six papers, *Greenhouse Gases: Science and Technology*, in prep. 2013  
Organizing Committee member, TOUGH Symposium, 2006, 2012.  
Faculty Affiliate, Energy Resources Group, U.C. Berkeley, January 2010 to present.  
Guest Editor of Special Issue on Geologic Carbon Sequestration, 15 papers, *Transport in Porous Media*, 52(1), 2010.  
Co-Chair of Organizing Committee (with Hui Hai Liu) of the 2009 Philomathia Forum on Energy and Environment, Berkeley-Stanford-Beijing Workshop on CCS, held in Beijing, China, 11-12 November 2009.  
Co-Convenor (with JP Nicot) of session at AGU Fall 2007 meeting, Monitoring and Modeling of CO<sub>2</sub> Migration Related to Geological Carbon Storage, December 2007.  
Co-Guest Editor of *Energy Conversion and Management* Special Issue on TOUGH2 Applications in CO<sub>2</sub> Storage and CH<sub>4</sub>-Hydrate Research, 2006.  
Associate editor of *Carbon Dioxide Capture for Storage in Deep Geologic Formations*, Vol. 2, D.C. Thomas and S.M. Benson, eds., Elsevier, 2005.  
Co-Guest Editor of *Vadose Zone Journal* Special Issue on TOUGH2 Applications in Hydrology, *Vadose Zone Journal*, 3, August 2004.  
Guest Editor of *Transport in Porous Media* Special Issue on Strongly Coupled Density-Dependent Flow in Porous Media, *Transport in Porous Media*, 47(2), May 2002.

## **COMMITTEE SERVICE AND ADVISORY BOARDS**

LBNL postdoc workshop, served on three-member panel for discussion on “Job Hunting at National Labs,” August 8, 2012.

GHGT-11, Kyoto, Japan, Expert Review Panel, 2012.

Advisory Board, ULTimateCO<sub>2</sub> Project, “Understanding the Long-Term fate of geologically stored CO<sub>2</sub>,” BRGM, France, 2011-present.

LBNL Materials for Energy Applications (MEA) workshop, Claremont Hotel, January 31-February 1, 2012, led development of two posters on CCS research conducted at eight National Laboratories.

TOUGH Steering Committee, Earth Sciences Division, LBNL, 2011-present.

LBNL Carbon Cycle 2.0 Steering Committee, 2011-present

LBNL Earth Sciences Division, Center for Nanoscale Control of Geologic Carbon (NCGC) Advisory Committee, 2011-present

Annual Carbon Capture, Utilization, and Storage Conference, Pittsburgh, PA, Conference Advisor, 2011-present.

LBNL Information Technology Advisory Committee (ITAC), ESD representative 2006-2009.

## **INVITED TALKS**

IEAGHG Joint Network Meeting on Modeling and Risk Management, Trondheim, Norway, June 11, 2013, “Process Modeling of Wellbore Leakage for GCS Risk Assessment.”

Gordon Research Conference, Invited Plenary Speaker, Les Diablerets, Switzerland, June 28, 2012, “On Carbon Sequestration and Utilization: CO<sub>2</sub> as Cushion Gas for Energy Storage.”

Big Sky Carbon Sequestration Partnership Annual Meeting, Great Falls, MT, April 18-19, 2012, “Geologic Modeling and Flow Simulation.”

Stanford University, Energy Resources Engineering, seminar, April 10, 2012, “On the Utilization of CO<sub>2</sub> as a Cushion Gas for Compressed Air Energy Storage.”

U.C. Berkeley, Energy Resources Group, seminar, February 8, 2012, “Geologic Carbon Dioxide Sequestration: A Direct Approach to Reducing Point-Source CO<sub>2</sub> Emissions.”

U.S. DOE Saline Formation GCS R&D Needs Workshop, October 18-21, 2011, “Simulation.”

U.C. Irvine, ICEPAG (Int. Colloq. on Env. Preferred Adv. Power Gen.), February 10-12, 2011, Costa Mesa, CA., “Coupling Geologic Carbon Sequestration and Compressed Air Energy Storage.”

U.C. Berkeley, Civil and Environmental Engineering, seminar, October 15, 2010, “Reducing Fossil Fuel CO<sub>2</sub> Emissions by Geologic Carbon Sequestration and Compressed Air Energy Storage.”

Berkeley Lab Science at the Theater, “Just Say No to Carbon Emissions,” Berkeley Repertory Theater, April 26, 2010, “Understanding Geologic Carbon Sequestration.”

LBNL Summer Lecture Series, seminar, July 21, 2009, “Geologic Carbon Sequestration: Mitigating Climate Change by Injecting CO<sub>2</sub> Underground.”

Stanford University, Environmental Fluid Mechanics and Hydrology, seminar, February 2, 2009, “Modeling CO<sub>2</sub> Leakage from Geologic Carbon Sequestration (GCS) Sites for Monitoring Design and Impact Assessment.”

U.C. Berkeley Institute of the Environment, seminar, November 13, 2008, “Geologic Carbon Sequestration: Near-Surface Challenges.”

U.C. Berkeley Energy Resources Collaborative (BERC) Conference, seminar, February 2008, “Challenges of Geologic Carbon Sequestration.”

Montana State University, Dept. of Chemistry/ZERT Project, seminar, April 11, 2007, “Near-Surface Dispersion of CO<sub>2</sub> Seepage from Geologic Storage Sites: Processes, Impacts, and Detection.”

Haas School of Business, March 6, 2007 “Geologic CO<sub>2</sub> storage: a safe and effective approach to reducing point-source CO<sub>2</sub> emissions.”

Energy INet Workshop, Calgary, January 26, 2006, “Migration Mechanisms and Potential Impacts of CO<sub>2</sub> Leakage and Seepage from CCS Projects.”

U.C. Davis, 2003, “Carbon Sequestration with Enhanced Gas Recovery.”

Stanford University, May 14, 2002, “CO<sub>2</sub> Injection for Carbon Sequestration with Enhanced Gas Recovery.”

## TEACHING

U.C. Berkeley, Co-taught *The Berkeley Lectures on Energy: Carbon Capture and Storage* (Chm Eng C295Z), Fall 2011, Spring 2013, Spring 2014.

Haas Professional School, geologic carbon sequestration, one lecture annually 2008-2014.

Haas School of Business class on Energy and Sustainability, one lecture, April 21, 2009.

Haas School of Business, one lecture, March 6, 2007.

## PATENTS

Process for guidance, containment, treatment, and imaging in a subsurface environment utilizing ferrofluids, U.S. Patent No. 6,250,848 B1, June 26, 2001. Inventors: G.J. Moridis and C.M. Oldenburg.

## AWARDS

2012 Editors’ Citation for Excellence in Refereeing for *Water Resources Research*, July 12, 2013.

Lawrence Berkeley National Laboratory, 2012 Director’s Award for Exceptional Achievement (for Tech Transfer related to the TOUGH codes).

DOE Secretary’s Achievement Award 2011 for Deepwater Horizon Oil Spill Flow Rate Technical Group work, October 2011.

Geothermal Resources Council, Best paper award to Rutqvist, Oldenburg, Dobson, Garcia, and Walters, for “The northwest Geysers EGS demonstration project Phase 1: Pre-stimulation prediction coupled geomechanical modeling to guide stimulation and monitoring plans, 2010 GRC Annual Meeting, Sacramento, CA.

USGS Director’s Award for Exemplary Service to the Nation, 2010 Deepwater Horizon Oil Spill Response.

Global Citizens Group Award at UN East Bay banquet on 10/24/08 at I-House. Honored for contribution to IPCC Special Report on Carbon Dioxide Capture and Storage.

Nobel Peace Prize 2007, IPCC shared with Al Gore, Jr., Contributing Author of the IPCC Special Report on Carbon Dioxide Capture and Storage.

#### **PEER-REVIEWED JOURNAL ARTICLES**

1. Oldenburg, C.M., C. Doughty, and N. Spycher, The role of CO<sub>2</sub> in CH<sub>4</sub> exsolution from deep brine: Implications for geologic carbon sequestration, *Greenhouse Gases: Sci. Tech.*, 3(5), 359-377, 2013. *LBNL-6513E*.
2. Rutqvist, J., P.F. Dobson, J. Garcia, C. Hartline, P. Jeanne, C.M. Oldenburg, D.W. Vasco, and M. Walters, The Northwest Geysers EGS Demonstration Project, California: pre-stimulation modeling and interpretation of the stimulation, *Mathematical Geosciences*, in press.
3. Birkholzer, J.T., J.-P. Nicot, C.M. Oldenburg, Q. Zhou, S. Kraemer, and K. Bandilla. "Reply to comments by Schnaar et al. on “Brine flow up a well caused by pressure perturbation from geologic carbon sequestration: Static and dynamic evaluations” by Birkholzer et al. (2011).” *International Journal of Greenhouse Gas Control*, 17, 544-545, 2013.
4. Vasco, D.W., J. Rutqvist, A. Ferretti, A. Rucci, F. Bellotti, P.F. Dobson, C.M. Oldenburg, J. Garcia, M. Walters, and C. Hartline, Monitoring deformation at The Geysers geothermal field, California, using C-band and X-band Interferometric Synthetic Aperture Radar, *Geophys. Res. Letts.*, in press.
5. Jordan, P.D., C.M. Oldenburg, and JP Nicot, Measuring and modeling fault density for CO<sub>2</sub> storage plume-fault encounter probability estimation, *AAPG Bulletin*, 97(4), 597-618, 2013.
6. Oldenburg, C.M., and L. Pan, Utilization of CO<sub>2</sub> as cushion gas for porous media compressed air energy storage, *Greenhouse Gases: Sci. Tech.*, 3(2), 124-135, 2013. *LBNL-6375E*.
7. Breunig, H.M., J.T. Birkholzer, A. Borgia, C.M. Oldenburg, P.N. Price, and T.E. McKone, Region evaluation of brine management for geologic carbon sequestration, *Int. J. Greenhouse Gas Control*, 14, 39-48, 2013.
8. Oldenburg, C.M., and L. Pan, Porous Media Compressed-Air Energy Storage (PM-CAES): Theory and Simulation of the Coupled Wellbore–Reservoir System, *Transport in Porous Media*, 97(2) 201-221, 2013. *LBNL-6529E*.

9. Mazzoldi, A., D. Picard, P.G. Sriram, and C.M. Oldenburg. Simulation-based estimates of safety distances for pipeline transportation of carbon dioxide, *Greenhouse Gases: Sci. Tech.*, 3(1), 66-83, 2013.
10. Nicot, J.-P., C.M. Oldenburg, J.E. Houseworth, and J.-W. Choi, Analysis of potential leakage pathways at the Cranfield, MS, USA, CO<sub>2</sub> sequestration site, *Int. J. Greenhouse Gas Control*, 18, 388-400, 2013.
11. Borgia, A., K. Pruess, T.J. Kneafsey, C.M. Oldenburg, and L. Pan, Numerical simulation of salt precipitation in the fractures of a CO<sub>2</sub>-enhanced geothermal system, *Geothermics*, 44, 13-22, 2012. *LBNL-5709E*.
12. Oldenburg, C.M., C. Doughty, C.A. Peters, and P.F. Dobson, Simulations of long-column flow experiments related to geologic carbon sequestration: Effects of outer wall boundary condition on upward flow and formation of liquid CO<sub>2</sub>, *Greenhouse Gases: Sci. and Tech.*, 2(4), 279–303, 2012. *LBNL-5811E*.
13. De Lary, L., A. Loschetter, O. Bouc, J. Rohmer, and C.M. Oldenburg, Assessing health impacts of CO<sub>2</sub> leakage from a geological storage site into buildings: Role of attenuation in the unsaturated zone and building foundation, *Int. J. Greenhouse Gas Control*, 9, 322-333, 2012.
14. Oldenburg, C.M., C. Doughty, C.A. Peters, and P.F. Dobson, Simulations of long-column flow experiments related to geologic carbon sequestration: Effects of outer wall boundary condition on upward flow and formation of liquid CO<sub>2</sub>, *Greenhouse Gases: Sci. and Tech.*, 2(4), 279–303, 2012. *LBNL-5811E*.
15. Pan, L., S.W. Webb, and C.M. Oldenburg, Analytical solution for two-phase flow in a wellbore using the drift-flux model, *Adv. Water Resour.*, 34(12), 1656-1665, 2011. *LBNL-5326E*.
16. Oldenburg, C.M., B.M. Freifeld, K. Pruess, L. Pan, S.A. Finsterle, and G.J. Moridis, Numerical simulations of the Macondo well blowout reveal strong control of oil flow by reservoir permeability and exsolution of gas, *Proc. National Acad. Sci., Early Edition*, July 5, 2011, *LBNL-5302E*.
17. Jordan, P.D., C.M. Oldenburg, and J.-P. Nicot (2011), Estimating the probability of carbon dioxide plumes encountering faults. *Greenhouse Gases: Sci. and Tech.*, 1(2), 160–174, 2011. *LBNL-5284E*.
18. Pan, L., C.M. Oldenburg, Y.-S. Wu, and K. Pruess, Transient CO<sub>2</sub> leakage and injection in wellbore-reservoir systems for geologic carbon sequestration, *Greenhouse Gases: Sci. and Tech.*, 1(4), 335-350, 2011. *LBNL-5248E*.
19. Birkholzer, J.T., J.-P. Nicot, C.M. Oldenburg, Q. Zhou, and S. Kraemer, Brine flow up a borehole caused by pressure perturbation from CO<sub>2</sub> storage: static and dynamic evaluations, *Int. J. Greenhouse Gas Control*, 5, 850-861, 2011. *LBNL-4864E*.
20. Oldenburg, C.M. and A.P. Rinaldi, Buoyancy effects on upward brine displacement caused by CO<sub>2</sub> injection, *Transport in Porous Media*, 87(2), 525-540, 2011. *LBNL-4116E*.

21. Oldenburg, C.M., and C. Doughty, Injection, Flow, and mixing of CO<sub>2</sub> in porous media with residual gas, *Transport in Porous Media*, 90, 201-218, 2011. *LBNL-4115E*.
22. Mathias, S.A., J.G. Gluyas, C.M. Oldenburg, and C.-F. Tsang, Analytical solution for Joule–Thomson cooling during CO<sub>2</sub> geo-sequestration in depleted oil and gas reservoirs, *Int. J. Greenhouse Gas Control*, 4(5), 806-810, 2010. *LBNL-3660E*.
23. Spangler, L.H., L.M. Dobeck, K.S. Repasky, A.R. Nehrir, S.D. Humphries, J.L. Barr, C.J. Keith, J.A. Shaw, J.H. Rouse, A.B. Cunningham, S.M. Benson, C.M. Oldenburg, J.L. Lewicki, A.W. Wells, J.R. Diehl, B.R. Strazisar, J.E. Fessenden, T.A. Rahn, J.E. Amonette, J.L. Barr, W.L. Pickles, J.D. Jacobson, E.A. Silver, E.J. Male, H.W. Rauch, K.S. Gullickson, R. Trautz, Y. Kharaka, J.T. Birkholzer, L. Wielopolski, (2010). A shallow subsurface controlled release facility in Bozeman, Montana, USA, for testing near surface CO<sub>2</sub> detection techniques and transport models. *LBNL-3079E. Environmental Earth Sciences*, 60(2), 227-239.
24. Oldenburg, C.M., J.L. Lewicki, L. Pan, L. Dobeck, and L. Spangler, Origin of the patchy emission pattern at the ZERT CO<sub>2</sub> release test, *Env. Earth Sci.*, 60(2), 241-250, 2010. *LBNL-3063E*.
25. Pan, L., J.L. Lewicki, C.M. Oldenburg, and M.L. Fisher, Time-windows-based filtering method for near-surface detection of leakage from geologic carbon sequestration sites, *Env. Earth Sci.*, 60(2), 359-369, 2010. *LBNL-3349E*.
26. Cortis, A., and C.M. Oldenburg, Short-range atmospheric dispersion of carbon dioxide, *Boundary-Layer Meteorology*, 133, 17-34, 2009. *LBNL-2964E*.
27. Oldenburg, C.M., J.L. Lewicki, L. Dobeck, and L. Spangler, Modeling gas transport in the shallow subsurface during the ZERT CO<sub>2</sub> release test, *Transport in Porous Media*, 82(1), 77-92, 2010. *LBNL-1529E*.
28. Price, P.N. and C.M. Oldenburg, The consequences of failure should be considered in siting geologic carbon sequestration projects, *Int. J. Greenhouse Gas Control*, 3(5), 658-663, 2009. *LBNL-2051E*.
29. Oldenburg, C.M., S.L. Bryant, and J.-P. Nicot, Certification framework based on effective trapping for geologic carbon sequestration, *Int. J. Greenhouse Gas Control*, 3, 444–457, 2009. *LBNL-1549E*.
30. Lewicki, J.L., G.E. Hilley, M.L. Fischer, L. Pan, C.M. Oldenburg, L. Dobeck, and L. Spangler, Eddy covariance observations of surface leakage during shallow subsurface CO<sub>2</sub> releases, *J. Geophys. Res.*, 114, D12302, 2009. *LBNL-1879E*.
31. Zhang, Y., C.M. Oldenburg, and S. Finsterle, Percolation-theory and fuzzy rule-based probability estimation of fault leakage at geologic carbon sequestration sites, *Env. Earth Sci.*, 59(7), 1447-1459, 2009. *LBNL-2172E*.
32. Gu, C., F. Maggi, W.J. Riley, G.M. Hornberger, T. Xu, C.M. Oldenburg, N. Spycher, N.L. Miller, R.T. Venterea, and C. Steefel, Aqueous and gaseous nitrogen losses induced by fertilizer application, *J. Geophys. Res. Biogeosci.*, 114, G01006, 2008. *LBNL-1689E*.

33. Cortis, A., C.M. Oldenburg, and S.M. Benson, The role of optimality in characterizing CO<sub>2</sub> seepage from geologic carbon sequestration sites, *Int. J. Greenhouse Gas Control*, 2, 640-652, 2008. *LBNL-1417E*.
34. Maggi, F., C. Gu, W.J. Riley, G.M. Hornberger, R.T. Venterea, T. Xu, N. Spycher, C. Steefel, N.L. Miller, and C.M. Oldenburg, A mechanistic treatment of the dominant soil nitrogen cycling processes: Model development, testing, and application, *J. Geophys. Res. Biogeosci.*, 113, G02016, 2008. *LBNL-486E*.
35. Lewicki, J.L., C.M. Oldenburg, L. Dobeck, and L. Spangler, Surface CO<sub>2</sub> leakage during two shallow subsurface CO<sub>2</sub> releases, *Geophys. Res. Lett.*, 34, L24402, 2007. *LBNL-63528*.
36. Oldenburg, C.M., Screening and ranking framework for geologic CO<sub>2</sub> storage site selection on the basis of health, safety, and environmental risk, *Environmental Geology*, 54, 1687-1694, 2008. *LBNL-63306*.
37. Oldenburg, C.M., Joule-Thomson cooling due to CO<sub>2</sub> injection into natural gas reservoirs, *Energy Conversion and Management*, 48, 1808-1815, 2007. *LBNL-60158*.
38. Zhang, Y., C.M. Oldenburg, S. Finsterle, and G.S. Bodvarsson, System-level modeling for economic evaluation of geological CO<sub>2</sub> storage in gas reservoirs, *Energy Conversion and Management*, 48, 1827-1833, 2007. *LBNL-62617*.
39. Oldenburg, C.M. and J.L. Lewicki, On leakage and seepage of CO<sub>2</sub> from geologic storage sites into surface water, *Env. Geol.*, 50(5), 691-705, 2006. *LBNL-59225*.
40. Lewicki, J.L., G.E. Hilley, and C.M. Oldenburg, An improved strategy to detect CO<sub>2</sub> leakage for verification of geologic carbon sequestration, *Geophys. Res. Letts.*, 32, L19403, 2005. *LBNL-57414*.
41. Su, G.W., B.M. Freifeld, C.M. Oldenburg, P.D. Jordan, and P.F. Daley, Interpreting Velocities from Heat-Based Flow Sensors by Numerical Simulation, *Ground Water*, 44(3), 386-393, 2005. *LBNL-57975*.
42. Oldenburg, C.M. and A.J.A. Unger, Coupled vadose zone and atmospheric surface-layer transport of CO<sub>2</sub> from geologic carbon sequestration sites, *Vadose Zone Journal*, 3, 848-857, 2004. *LBNL-55510*.
43. Zhang, Y., C.M. Oldenburg, and S.M. Benson, Vadose zone remediation of carbon dioxide leakage from geologic carbon dioxide sequestration sites, *Vadose Zone Journal*, 3, 858-866, 2004. *LBNL-54680*.
44. Oldenburg, C.M., S.W. Webb, K. Pruess, and G.J. Moridis, Mixing of stably stratified gases in subsurface reservoirs: a comparison of diffusion models, *Trans. Porous Med.*, 54(3), 323-334, 2004. *LBNL-51545*.



45. Borglin, S.E., T.C. Hazen, C.M. Oldenburg, and P.T. Zawislanski, Comparison of aerobic and anaerobic biotreatment of municipal solid waste, *J. Air and Waste Management Assoc.*, 54, 815-822, 2004. *LBNL-50576*.
46. Todesco, M., J. Rutqvist, G. Chiodini, K. Pruess, and C.M. Oldenburg, Modeling of recent volcanic episodes at Phlegrean Fields (Italy): Geochemical variations and ground deformation. *Geothermics*, 33(4), 531–537, 2004. *LBNL-53603*.
47. Oldenburg, C.M., S.H. Stevens, and S.M. Benson, Economic feasibility of carbon sequestration with enhanced gas recovery (CSEGR), *Energy*, 29, 1413–1422, 2004. *LBNL-49762*.
48. Pruess, K., J. Garcia, T. Kavscek, C. Oldenburg, J. Rutqvist, C. Steefel, and T. Xu, Code intercomparison builds confidence in numerical simulation models for geologic disposal of CO<sub>2</sub>, *Energy*, 29, 1431–1444, 2004. *LBNL-52211*.
49. Oldenburg, C.M. and A.J.A. Unger, On leakage and seepage from geologic carbon sequestration sites: unsaturated zone attenuation, *Vadose Zone Journal*, 2(3), 287-296, 2003. *LBNL-51928*.
50. Salve, R., C.M. Oldenburg and J.S.Y. Wang, In situ flow experiments in nonwelded tuff: conceptual models and implications for flow in the PTn., *J. Contam. Hydrol.*, 62-63, 269-286, 2003. *LBNL-48869*.
51. Oldenburg, C.M., Carbon dioxide as cushion gas for natural gas storage, *Energy & Fuels*, 17, 240-246, 2003. *LBNL-51053*.
52. Zhou, Q.L., H.-H. Liu, G.S. Bodvarsson, and C.M. Oldenburg, Flow and transport in unsaturated fractured rock: effects of multiscale heterogeneity of hydrogeologic properties, *J. Contam. Hydrol.*, 60, 1–30, 2003. *LBNL-50503*.
53. Salve, R. and C.M. Oldenburg, Water flow within a fault in altered nonwelded tuff, *Water Resour. Res.*, 37(12), 3043-3056, 2001. *LBNL-45844*.
54. Oldenburg, C.M., K. Pruess, and S.M. Benson, Process modeling of CO<sub>2</sub> injection into natural gas reservoirs for carbon sequestration and enhanced gas recovery, *Energy & Fuels*, 15, 293–298, 2001. *LBNL-45820*.
55. Oldenburg, C.M. and K. Pruess, Simulation of propagating fronts in geothermal reservoirs with the implicit Leonard total variation diminishing scheme, *Geothermics*, 29, 1–25, 2000. *LBNL-42620*.
56. Oldenburg, C.M., S.E. Borglin, and G.J. Moridis, Numerical simulation of ferrofluid flow for subsurface environmental engineering applications, *Trans. Porous Med.*, 38, 319–344, 2000. *LBNL-40146*.
57. Borglin, S.E., G.J. Moridis, and C.M. Oldenburg, Experimental studies of the flow of ferrofluid in porous media, *Trans. Porous Med.*, 41, 61–80, 2000. *LBNL-40126*.

58. Freifeld, B.M. and C.M. Oldenburg, The restricted interval Guelph permeameter: theory and application, *Water Resour. Res.*, 36(6), 1373–1380, 2000. *LBL-42135*.
59. Oldenburg, C.M. and K. Pruess, Plume separation by transient thermohaline convection in porous media, *Geophys. Res. Lett.*, 26(19), 2997–3000, 1999. *LBL-43133*.
60. Oldenburg, C.M. and K. Pruess, Layered thermohaline convection in hypersaline geothermal systems, *Trans. Porous Med.*, 33, 26–63, 1998. *LBL-39350*.
61. Bennett, D.H., A.L. James, T.E. McKone, and C.M. Oldenburg, On uncertainty in remediation analysis: variance propagation from subsurface transport to exposure modeling, *Reliability Engineering and System Safety*, 62, 117–129, 1998. *LBL-41335*.
62. Pruess, K., S. Finsterle, G. Moridis, C. Oldenburg, and Y.-S. Wu, General-Purpose Reservoir Simulators: The TOUGH2 Family, *GRC Bulletin*, 26(2), 53–57, both *LBL-39927*, *LBL-40140*, 1997.
63. James, A.L. and C.M. Oldenburg, Linear and Monte Carlo uncertainty analysis for subsurface contaminant transport simulation, *Water Resour. Res.*, 33(11), 2495–2508, 1997. *LBL-38507*.
64. Oldenburg, C.M., K. Pruess, and B.J. Travis, Reply to Comment on "Dispersive transport dynamics in a strongly coupled groundwater brine flow system," *Water Resour. Res.*, 32(11), 3411–3412, 1996.
65. Oldenburg, C.M. and K. Pruess, Mixing with first-order decay in variable velocity porous media flow, *Trans. Porous Med.*, 22, 161–180, 1996. *LBL-35735*.
66. Spera, F.J., C.M. Oldenburg, C. Christensen, and M. Todesco, Simulations of convection with crystallization in the system  $\text{KAlSi}_2\text{O}_6\text{-CaMgSi}_2\text{O}_6$ : Implications for compositionally zoned magma bodies, *Am. Mineralogist*, 80, 1188–1207, 1995.
67. Oldenburg, C.M. and K. Pruess, Dispersive transport dynamics in a strongly coupled groundwater brine flow system, *Water Resour. Res.*, 31(2), 289–302, 1995. *LBL-34487*.
68. Oldenburg, C.M. and K. Pruess, On numerical modeling of capillary barriers, *Water Resour. Res.*, 29(4), 1045–1056, 1993. *LBL-32229*.
69. Oldenburg, C.M. and F.J. Spera, Hybrid model for solidification and convection, *Num. Heat Trans. B*, 21, 217–229, 1992. *LBL-29899*.
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## **METRICS**

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